Species Composition and Biomass Productivity of Agro-Silvopastoral Fodder Banks in Tanzania

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Introduction

Optimal ruminant livestock production in many countries in the tropics is constrained by both low quantity and quality of feed resources with the dry season being the most limiting. Studies done in many semiarid areas, for instance in agro-silvopastoral fodder banks of northwestern Tanzania, demonstrate herbage species composition of low nutritive values with low crude protein (CP) concentration of 16 – 26 g/kg DM and biomass productivity of 1.5 t DM/ha (Rubanza *et al*. 2006). Cattle grazed on standing hay pastures in the dry season recorded low average daily weight gains (ADG) of 0.02 – 0.14 g/d compared to improved growth rate of 0.26 g/d upon correction of CP in the diet through supplementation with tree leaf meal (Rubanza *et al*. 2005). Information is lacking on rangeland herbage species composition, herbage forage biomass productivity, and nutritive values of grazing land forages in many parts of the tropics including semiarid areas of central Tanzania in Kiteto and Kongwa districts in particular. A study was conducted in the dry season between July and September 2013 through the Africa RISING project to: (1) determine herbaceous species composition and biomass productivity in grazing lands, and (2) determine nutritive value of dry season standing hay herbage forage.

Materials and methods

Study site

The study was carried out in selected rangelands of two semiarid districts of central Tanzania in Kiteto (4º31' – 6º03' South; 36º15' – 37º 5' East) with an elevation of 1000 – 1500 m above sea level and Kongwa district (5º30' – 6º0' South; 36º15' – 36º E) with an elevation of about 900 – 1000 m asl.

Estimation of Rangelands Species Composition and Biomass Productivity

Rangelands herbage species composition, basal cover, and biomass productivity were quantified using a point sampling technique (Piepper *et al.* 1978; Crowder and Chheda 1982). A metal frame quadrat (0.5 m x 0.5 m) was systematically thrown at 5 m pace in two diagonals and a bisector. Herbaceous species composition were estimated as a proportion of grass and forb species. Herbages clipping was done at 5 cm above the ground for determination of fresh weight and dry matter (DM) . Biomass productivity was computed from weights of herbages in individual quadrats and expressed in t DM/ ha basis.

Results and discussion

Herbaceous species composition

The rangelands had variable herbage species composition (Table 1). Dominant herbage species were *Cynodon* spp. (30.5%), *Aristida* spp. (11.4%), *Dicanthium* spp. (17.8%), *Cenchrus ciliaris* (12.9%), *Panicum* spp. (11.7%), and *Eragrostis* spp. (9.2%). Grazing value of rangelands is threatened by persistence of weeds such as *Heliotropium steudneri*. 2525. The recorded herbaceous species composition depicts common forage species dominant in many grazing lands in the tropics. Some of the observed dominant forage species such as *Cenchrus ciliaris*, *Cynodon* spp., and *Eragrostis* spp. represent forage species of promising nutritive value (Crowder and Chhedda 1982; Rubanza *et al*. 2006). Forage species such as *Cenchrus ciliaris*, *Cynodon dactylon,* and other *Cynodon* spp. and *Eragrostis* spp. represent some 'decreaser' grass species in many rangelands. *Genchrus ciliaris* has good grazing value (Pratty and Gwyne 1977).

Biomass productivity

Rangelands forage biomass productivity is presented in Figure 1. Herbage forage biomass productivity was highly variable across rangeland sites ($P<0.05$), plots within rangelands ($P<0.001$), and due to interaction effects of rangeland sites and plots within the given rangelands ($P<0.001$). The assessed gazing land had variable ($P<0.05$) forage biomass productivity ranging from 1.74 to 2.65 t DM/ ha. The low biomass productivity of 1.74 to 2.65 t DM/ha clearly show inadequate supply of biomass in the grazing land forages during the dry season. The observed low biomass productivity of the *Alalili* silvopastoral fodder banks and other natural grazing lands in the two districts were comparable to 1.5 t DM/ha noted for *Ngitili* agro-silvopastoral rangelands of Shinyanga region.

The low herbage forage biomass productivity is further exacerbated by the overstocking. The estimated carrying capacity of less 0.89 animal unit (AU) further link to the low biomass productivity of the grazing lands under the current study in the two districts. The noted low biomass productivity was comparable to low biomass productivity of 1.5 DM/ ha recorded in natural grazing lands of Meatu district (Rubanza *et al*., 2006). The noted low herbage forage biomass productivity coupled with low nutritive values of these forages to a large extent would be associated with poor animal performance of livestock grazed on these forages.

Table 1. Herbaceous species Composition

Herbage species	Composition (%)
Aristida spp.	11.4
Cenchrus ciliaris	12.9
Cynodon dactylon	15.9
Cynodon spp.	14.6
Dicanthium spp.	17.8
Eragrostis spp.	9.2
Heliotropium steudneri	6.5
Panicum spp.	11.7
Total	100.0

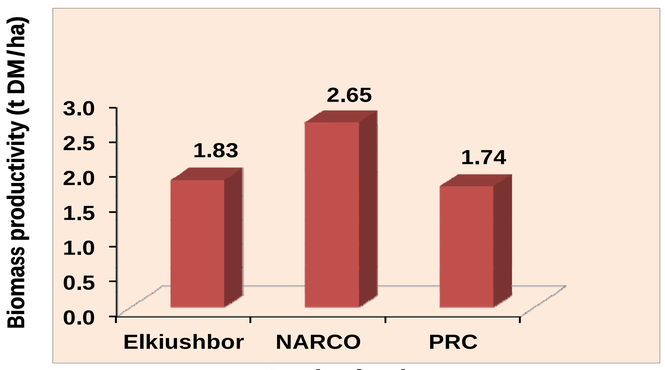

Figure 1. Herbage forage biomass productivity.

Forage Nutritive Values

The low crude protein (CP) content of the forages ranged from 28 to 60 g/kg DM. This range is lower than the recommended CP of 80 g/kg DM for optimal ruminal functioning. It is thus imperative to supplement feed for livestock fed on these low quality basal forages found in the study sites, especially during dry seasons. Browse tree foliages represent the available alternative.

Conclusion and Recommendations

The grazing lands studied were characterized by promising herbage species composition. However, animal productivity from these grazing land forages is limited by their biomass productivity as indicated by low carrying capacity due to the typical heavy grazing pressure. Tree planting through enrichment planning with fertilizer trees to cater to both soil fertility improvement and fodder for livestock is encouraged to improve productivity and quality of pastures and provide other products (Fig. 2).

Figure 2. Livestock feeding on leaves of *Senna siamea* cut by the boy on top of a tree as feed supplements at Molet Village, Kongwa districts, Dodoma, Tanzania. Introduction of high-quality fodder species in this and other Africa RI|SING villages holds high potential to improve pasture quality and quantity. Photo credit: Anthony Kimaro

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